

Biology	Group-II	PAPER: II
Time: 2.40 Hours	(SUBJECTIVE TYPE)	Marks: 68

SECTION-I

2. Write short answers to any EIGHT (8) questions: 16

(i) Differentiate between osmoconformers and osmoregulators.

Ans Differences between osmoconformers and osmoregulators:

Osmoconformers

Animal body fluids are kept isotonic to the external environment even for marine saltwater environment. These animals, thus, do not require actively to adjust their internal osmotic state, so are known as osmoconformers.

Osmoregulators

The animals whose body fluid concentrations differ noticeably the outside environment actively regulate to discharge excess water in hypotonic and excrete salts in hypertonic conditions, therefore, are called as osmoregulators in tabular form.

(ii) Define uremia. What is its permanent treatment?

Ans Dialysis may be used as a temporary measure. In high degree renal failure also called as **uremia** or **end-stage renal disease**, the dialysis cannot be done hence thus the surgical transplantation of a matching donor kidney is the only option left for as the permanent treatment.

(iii) Define pyrexia and pyrogens.

Ans **Pyrexia:**

Pyrexia is a condition of high body temperature above the normal point of 37°C.

Pyrogens:

In bacterial and viral infections mainly, leukocytes increase in number. These pathogens and the blood cells produce chemicals called is **pyrogens**. Pyrogens displace the set point of hypothalamus above the normal point of 37°C. Fever or high temperature helps in stimulating the protective mechanisms against the pathogens.

(iv) Define Herniation of disc. How is it treated?

Ans Severe or sudden physical trauma to spines, for example, from bending forward while lifting a heavy object may result in **herniation** of one or more discs. The herniated disc (commonly known slipped disc) usually involves rupture of annulus fibrosus followed by protrusion of the spongy nucleus pulposus. If protrusion presses on spinal cord or on spinal nerves exiting from cord generate severe pain or even destruction of these nervous structure. Disc slip is treated with bed rest, traction and painkiller. If this fails disc may be removed surgically.

(v) Differentiate between bone and cartilage.

Ans Differences between bone and cartilage:

Bone	Cartilage
1. It is the most rigid form of connective tissue.	1. It is much softer than bone.
2. The collagen fibers of bone are hardened by deposit of calcium phosphate.	2. The living cells of cartilage are called chondrocytes. These cells secrete flexible cartilage that surround chondrocytes.
3. Bones supporting your arms and legs consist of outer shell of compact bone, with spongy bone in the interior.	3. It supports the flexible portion of nose and external ears.

(vi) Give two modifications in the exoskeleton of arthropods.

Ans The most complex exoskeleton is found among the arthropods. The arthropods have made a variety of adaptation to allow them to live and grow within their exoskeleton. The invagination of exoskeleton forms firm ridges and bars for muscle attachment. Another modification of exoskeleton is the formation of joints. The exoskeleton are thin, soft and flexible at joints, consequently joint move very easily. Other modifications of exoskeleton include sensory receptors called sensilla that are in the form of bristles, and lenses and the modification of the exoskeleton that permits gaseous exchange.

(vii) What is seed dormancy? Write its significance.

Ans **Seed Dormancy:**

It is the special condition of rest, which enables an embryo to survive the long periods of unfavourable environmental conditions, such as water scarcity or low temperature. During this period of rest the embryo ceases or limits its growth.

Significance:

1. This is of great survival importance of the plant in that it prevents the dormant seed from germinating in response to conditions such as a warm spell in winter, which, although apparently favourable, are only temporary.
2. Germination or resumption of normal growth by a dormant embryo requires certain, very precise combinations of environmental cues, to avoid any accidental stimulus which may prove fatal later on.

(viii) Write the functions of sertoli cells and interstitial cells.

Ans The spermatids differentiate into mature sperms. Fluid secreted by **sertoli cells** provides liquid medium, protection and nourishment to sperms while they are in the tubules. The sperms are then transferred to the main duct of the male reproductive tract.

Between the seminiferous tubules are **interstitial cells** which secrete **testosterone**. This hormone is essential for the successful production of sperms and also controls the development of male secondary sexual characteristics during puberty.

(ix) Characterize limnetic zone and profundal zone of freshwater lake.

Ans **Limnetic zone:**

In this zone, enough light penetrates to support photosynthesis. Here, phytoplankton includes cyanobacteria (blue-green algae) which serve as producers. These are eaten by protozoa and small crustaceans, which in turn are consumed by fishes.

Profundal zone:

Here, light is insufficient to support photosynthesis. The organisms of this zone are mainly nourished by detritus that falls from the littoral and limnetic zone and by incoming

sediment. Decomposers and detritus feeders, such as, snails and certain insect larvae, bacteria, fungi and fishes, inhabit it.

(x) Write down the name of two dominant plants and two dominant animals of temperate deciduous forest.

Ans Dominant plants of temperate deciduous forests are *Taxus baccata* and *Pinus wallichiana*.

Dominant animals of temperate deciduous forests are *Selenarctos tibetanus* (black bear) and *Felis bengalensis* (leopard cat).

(xi) What is nutrient cycle? What is driving force behind these cycles?

Ans The chemical elements essential for life in living organisms are called biogenic elements or nutrient elements. **Macronutrients** are elements required by organism in large amount like water, carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur and calcium. **Micronutrients** are elements required by organisms in small quantity or in trace amount like zinc, molybdenum, iron, iodine, the nutrient cycles are also called biogeochemical cycles as the nutrients move from living to non-living to living portions of ecosystem in a cyclic manner.

(xii) Write four effects of removal of forests.

Ans Following are the four effects of removal of forests:

1. About half of the rain which falls in tropical forests comes from the transpiration by the trees themselves which also keep the environment cool and humid. When forests are removed, this source of rain is also removed.
2. Cloud cover is reduced and the local climate changes quite dramatically.
3. The temperature range from day to night is more extreme.
4. The difference between day and night temperatures increases considerably, and the rainfall diminishes.

3. Write short answers to any EIGHT (8) questions: (16)

(i) What condition result due to hypo and hyper function of cortical hormones?

Ans The destruction of the adrenal cortex, such as occurs in Addison's disease, will lead to general metabolic disturbance, in particular, weakness of muscle action and loss of salts. Stress situations, such as cold, which would normally be overcome,

lead to collapse and death. The reverse of this is found in Cushing's disease where too much cortical hormone is produced. Symptoms are an excessive protein breakdown resulting muscular and bone weakness. The high blood sugar disturbs the metabolism as in diabetes.

(ii) **Write the actions of nicotine on nervous and circulatory system.**

Ans Nicotine affects post synaptic membrane in CNS and PNS. It mimics the action of acetylcholine on nicotine receptors, so it is stimulant of nerve impulse. It increases the heart beat rate, blood pressure and digestive tract mobility. Nicotine may induce vomiting and diarrhoea and even may cause water retention relation by kidneys.

(iii) **Define imprinting with the example of precocial birds.**

Ans **Imprinting:**

Imprinting is a form of learning which is best known in birds such as geese, ducks, and chickens, which are all precocial birds. Shortly after hatching, ducklings and other young birds have a tendency to follow moving objects in their surroundings. They show a brief sensitive period during which the shape of form of objects can be 'imprinted', with the result that the young birds will follow them. Normally, of course, the first moving object encountered is the mother bird, and it is obviously adaptive for the young birds to learn her appearance and to follow her. However, if its parents are absent, a young bird may imprint on other species of birds, human beings, or inanimate objects.

(iv) **Differentiate between X-linked dominant and X-linked recessive traits.**

Ans Differences between X-linked dominant and X-linked recessive traits:

X-linked dominant trait	X-linked recessive trait
1. X-linked dominant is a trait which is determined by an X-linked dominant gene.	1. X-linked recessive is a trait that is determined by an X-linked recessive gene.
2. Hypophosphatemic rickets is an X-linked dominant trait.	2. Haemophilia is a rare X-linked recessive trait.

(v) Define monohybrids and dihybrids.

Ans Monohybrids:

The offsprings produced after a monohybrid cross *i.e.*, the cross between homozygous individuals with different alleles for a single gene locus of interest, are called monohybrids.

Dihybrids:

The offsprings produced after a dihybrid cross *i.e.*, the cross between individuals with different alleles for two gene loci of interest, are called dihybrids.

(vi) Define linkage. Enlist linkage groups of chromosome no. 11 and 23.

Ans Every organism possesses numerous characters controlled by thousands of genes, but the number of chromosomes is limited. Therefore, each chromosome must carry many genes on it. All the genes located on the same chromosome are linked to each other. This phenomenon of staying together of all the genes of a chromosome is called **linkage**. Gene linkage is a physical relationship between genes. A chromosome carries its linked genes en bloc in the form of a linkage group. The number of linkage groups corresponds to the number of homologous pairs of chromosomes. Man has 23 linkage groups. Genes for colour blindness, haemophilia, gout, etc. form one linkage group on human X-chromosome. Similarly, gene for sickle cell anaemia, leukemia and albinism make another linkage group on human chromosome 11.

(vii) What do you know about palindromic sequence? Give an example.

Ans Bacteria produce a variety of such restriction enzymes, which cut the DNA at very specific sites characterized by specific sequence of four or six nucleotides arranged symmetrically in the reverse order. Such sequences are known as **palindromic sequences**. So far more than 400 such enzymes have been isolated out of which about 20 are frequently used in recombinant DNA technology.

EcoR1, a commonly used restriction enzyme, cuts double-stranded DNA when it has this sequence of bases at the cleavage site.

(viii) What are protoplasts? Give scientific name of biodegradable plastic.

Ans Immature plant embryos, or into plant cells that have had the cell wall removed are called **protoplasts**. It is possible to treat protoplasts with an electric current while they are suspended in a liquid containing foreign DNA.

The scientific name of biodegradable plastic is polyhydroxy-butyrate.

(ix) Give the process of coronary artery angioplasty briefly, using biotechnology.

Ans During coronary artery angioplasty, a balloon catheter is sometimes used to open up a closed artery. Unfortunately, the artery has a tendency to close up once again. But investigators have come up with a new procedure. The balloon is coated with a plasmid that contains a gene for vascular endothelial growth factor. The expression of the gene, which promotes the proliferation of blood vessels to bypass the obstructed area, has been observed in at least one patient.

(x) Differentiate between food chain and food web.

Food Chain	Food Web
Food chain is linear relationship of eating and being eaten.	Food web is the combination of many food chains.

(xi) Define ammonification and nitrification.

Ans Much of the nitrogen found in the soil is the result of the decomposition of organic materials and is in the form of complex organic compounds, such as proteins, amino acids, nucleic acids and nucleotides. These nitrogenous compounds are usually rapidly decomposed into simple compounds by soil-dwelling organisms chiefly bacteria and fungi. These micro-organisms use the proteins and amino acids and release excess of ammonia (NH_3) or ammonium ions (NH_4^+). This process is known as *ammonification*.

Several bacteria in soil are able to oxidize ammonia or ammonium ions. This oxidation is known as *nitrification*.

(xii) State parasitism and its significance.

Ans Parasitism and its Significance:

This is an association between a host and a parasite, which involves providing the parasite with food, protection and conditions for its survival. The parasite may or may not harm the host. Diseases in living organisms, which are caused by parasites are called **infestations**. Parasites may be **ectoparasites**, living outside the body of the host e.g., fungi causing dandruff in hair and **endoparasites**, living inside the body of the host e.g., tapeworm in intestine of man.

4. Write short answers to any SIX (6) questions: (12)

(i) Define apical meristem.

Ans **Apical Meristem:**

The apical meristems are found at the tips of roots and shoot and are primarily concerned with the extension of plant body. These are perpetual growth zones found at the apices of roots and stems. They are responsible for increase in the number of cells at the tips of roots and stem. So, they play important role in primary growth.

(ii) What is inhibitory effect?

Ans Thimann and Skoog, in 1934, performed experiments and showed that apical dominance was caused by auxin diffusing from the apical bud which inhibited the growth of lateral shoots is called inhibitory effect.

(iii) Define transcription.

Ans This is the process in which an RNA copy of the DNA sequence encoding the gene is produced with the help of an enzyme, RNA polymerase. Only one of the two strands of DNA are transcribed. This strand is called **template** strand or the **antisense** strand. The opposite strand is called **coding** strand or the **sense** strand. The RNA polymerase enzymes synthesize RNA from 5' → 3' direction. There is only one type of RNA polymerase in prokaryote which is responsible for the synthesis of all the three types of RNAs viz, rRNA, mRNA, and tRNA. On the other hand, there are three types of RNA polymerases in eukaryotes namely RNA polymerase I, which synthesizes rRNA, RNA polymerase II, which synthesizes mRNA and RNA polymerase III which synthesizes tRNA.

(iv) Differentiate between heterochromatin and euchromatin.

Ans Highly condensed portions of the chromatin are called heterochromatin. Some of these portions remain permanently condensed, so that their DNA is never expressed. On the other hand, the remainder of the chromosome called euchromatin condensed only during cell division, when compact packaging facilitates the movement of the chromosomes.

(v) What are three main components of a DNA?

Ans DNA contains three main components *i.e.*, (1) phosphate (PO_4) groups, (2) five carbon sugars, and (3) nitrogen containing bases called purines (adenine, A, and guanine, G) and pyrimidines (thymine, T and cytosine, C, RNA contains uracil, U, instead of T).

(vi) Differentiate between leptotene and zygotene.

Ans Differences between leptotene and zygotene:

Leptotene	Zygotene
1. In this stage of prophase I, the chromosomes become visible, shorten and thick.	1. In this stage of prophase I, first essential phenomenon of meiosis <i>i.e.</i> , pairing of homologous chromosomes called synapsis starts.
2. The size of the nucleus increases and homologous chromosomes start getting closer to each other.	2. The pairing is highly specific but with no starting point. Each paired but not fused, complex structure is called bivalent or tetrad.

(vii) Explain Turner's syndrome.

Ans These individuals have one missing x chromosome with only 45 chromosomes (44 autosomes of x). Individuals with this condition often do not survive pregnancy and are aborted. Those who survive have female appearance with short stature, webbed neck, without ovaries and complete absence of germ cells.

(viii) How genetic drift effect gene frequency?

Ans Genetic drift:

It is the change in frequency of alleles at a locus that occurs by chance. In small populations, such fluctuations may

lead to the loss of particular alleles. This may occur in a small population when a few individual fail to reproduce and then genes are lost from the population.

(ix) What are homologous organs?

Ans Homologous organs are functionally different but structurally alike e.g., Forelimbs of man, bat, horse, whale, etc. are example of divergent evolution.

SECTION-II

NOTE: Attempt any Three (3) questions.

Q.5.(a) Explain the structure of nephron.

(4)

Ans Nephron:

The functional units, nephrons, in human kidneys are arranged along two distinct regions, an outer **cortex** and an inner **medulla**. The nephrons arranged along the cortex are called as **cortical**, however, those arranged along the border of cortex and medulla with their tubular system looping deep in inner medulla are **juxtamedullary nephrons**. These juxtamedullary nephron are specially instrumental in the production of concentrated urine.

In each nephron, inner end forms a cup-shaped swelling, called **Bowman's capsule** and it is around a ball of capillaries called **glomerulus**. Glomerulus circulates blood through capsule as it arrives through **afferent arteriole** and leaves the capsule by **efferent arteriole**. The blood vessel subdivides again into another network of capillaries, the **peritubular capillaries**. Bowman capsule continues as extensively convoluted **proximal tubule**, **loop of Henle** and the **distal tubule**, which empties into **collecting tubules**. The collecting tubules open into pelvis. The filtrate from glomerulus passes through these structures and is processed ultimately for urine formation. The peritubular capillaries intermingle with proximal and distal tubules of the nephron. In juxtamedullary nephrons, additional capillaries extend down to form a loop of vessels, **vasa recta**.

Filtration:

Blood passing through glomerulus is filtered into Bowman's capsule. It is specifically filtered here, unlike at the other parts of the vessels, because glomerulus walls are porous, and the fraction of the blood pressure reaching here provides the filtration pressure. The filtrate appearing in Bowman's capsule is called as glomerular filtrate, which contains numerous useful substances such as glucose, amino acids, salts, etc. in aqueous solution.

Reabsorption:

All the useful constituents of the glomerular filtrate are reabsorbed in proximal tubules and when filtrate leaves proximal tubules, it mostly contains nitrogenous wastes.

Secretion:

The tubular epithelium also secretes substances into the lumen, this secretion is very selective and is mainly of hydrogen ions to balance pH value of the filtrate passing through the tubule.

(b) Describe predation and parasitism with their significance. (4)

Ans Predation and its Significance:

An animal that preys on other animals is a predator. A predator is a consumer. The animal that is caught and eaten is the prey. The overall process is called predation.

The sizes of populations of predator and prey are related to each other. The size of each population is determined by the size of the other. If the number of prey is large, this leads to an increase in the number of predators; as predator feeds upon the prey, the number of prey begins to fall. The number of predators also decreases, since they have smaller food supply. As the number of predators decreases, the number of prey begins to increase. This food relationship of predator-prey creates a "cycle".

Examples: cat/mouse, fox/rabbit, seal/fish, frog/mosquito, hawk/small birds, etc.

Parasitism and its Significance:

This is an association between a host and a parasite, which involves providing the parasite with food, protection and conditions for its survival. The parasite may or may not harm the host. Diseases in living organisms, which are caused by

parasites are called infestations. Parasites may be ectoparasites, living outside the body of the host e.g., fungi causing dandruff in hair and endoparasites, living inside the body of the host e.g., tapeworm in intestine of man.

Q.6.(a) Write a note on sclerenchyma cells and collenchyma cells. (4)

Ans **Sclerenchyma:**

They have thick secondary cell walls usually impregnated with lignin, an organic substance that makes the walls tough and hard. Most of the sclerenchyma cells are non-living. Their primary function is to provide support to the plant parts.

There are three types of sclerenchymatous cells:

(i) Fibers (Tracheids):

These are long and cylindrical and they may exist as solid bundles in xylem or as bundle caps.

(ii) Sclereides:

These are shorter than fibers and are found in seed coats and nut shells and provide protection.

(iii) Vessels (Tracheae):

Long tubular structures, join end to end to form long water conducting pipe in xylem.

Collenchyma Cells:

Collenchyma cells have protoplasts and usually lack secondary walls. They have angular thickening in their primary walls. They are usually grouped in strands or cylinders. Collenchyma cells provide support to young herbaceous parts of the plant. Young stems, for instance, often have a cylinder of collenchyma just below their surface. Collenchyma cells are elastic, elongate with the growth of stems and leaves.

(b) Explain Watson and Crick Model of DNA. (4)

Ans Learning informally of Franklin's results, before they were published in 1953, James Watson and Francis Crick, two young researchers in University of Cambridge, quickly worked out a likely structure of the DNA molecule, which we now know was substantially correct. They proposed that molecule is a simple double helix, with the basis of two strands pointed inward toward each other, forming base-pairs. In their model, base pairs always consist of purines, which are large, pointing toward pyrimidines which are small, keeping the diameter of the

molecule a constant 2 nm. Because hydrogen bonds exist between the bases in a base pair, the double helix is stabilized as a duplex DNA molecule composed of two anti-parallel strands, one chain running 3' to 5' and the other 5' to 3'. The base pairs are planar (flat) and stack 0.34 nm apart as a result of hyperphobic interactions contributing to the overall stability of the molecule. In the double helix, adenine forms two hydrogen bonds with thymine, while guanine forms three hydrogen bonds with cytosine. Adenine will not form proper hydrogen bonds with cytosine and guanine will not form hydrogen bonds with thymine. Consequently, adenine and thymine will always occur in the same proportion in any DNA molecule, as well guanine and cytosine, because of this base pairing.

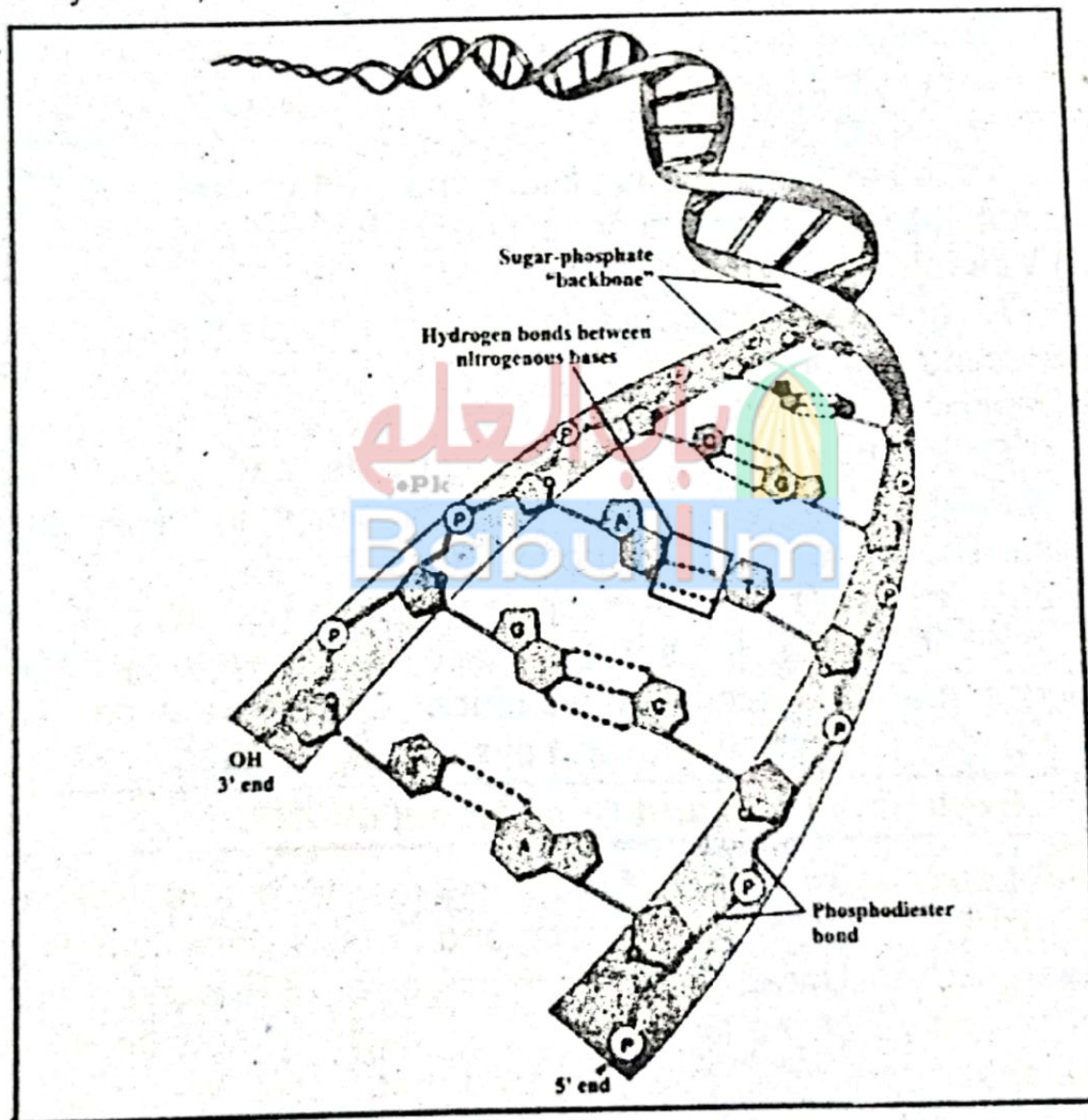


Fig. DNA is a double helix.

Q.7.(a) What is resting membrane potential? How is resting membrane potential maintained across neurolema? (4)

Ans Nerve impulse is a wave of electrochemical changes, which travels along the length of the neuron involving chemical reactions and movement of ions across the cell membrane. Electrical potential is a measure of the capacity to do electrical work. It represents a type of stored energy which is manifested during separation of charges across a barrier. In the case of neuron, the charges are positive and negative ions, and the charge separating barrier is the plasma membrane. The electrical potential that exists across a cell membrane is known as membrane potential. A typical neuron at rest is more positive electrically outside than inside the cell membrane. This net difference in charge between the inner and the outer surface of a non-conducting neuron is called the resting membrane potential. The major factors which are involved in resting membrane potential are:

1. Sodium and potassium ions:

Of the many kinds of ions present in the nerve cells and the surrounding fluid, sodium (Na^+) and potassium (K^+) ions are the most important. Sodium ions are tenfold higher in concentration outside than inside the membrane surface, whereas potassium ions are twenty times more concentrated inside than outside. All the neurons have very active sodium and potassium pumps located in their cell membranes. Driven by the splitting of ATP, these pumps transport Na^+ out and K^+ into the cell, both against their respective concentration gradients. For every two K^+ that are actively transported inward, three Na^+ are pumped out. So inside becomes more negative than the outside of the cell membrane of neurons.

2. Negative organic ions:

The large negative organic ions (such as proteins, organic acids, etc.) are much more inside the membrane than outside, where they are only in negligible concentration. This makes the inside of neuron membrane more negative.

3. Leakage of K^+ ions from neurons:

The cell membrane is virtually impermeable to all ions except K^+ . Since the membrane is slightly permeable to K^+ , some of it leaks out of the cell. The loss of this positive ion from the neuron by diffusion accounts for more negative charges inside than outside the cell membrane of neuron.

Ans Importance of Forests:

Forests are very important component of the human environment. They provide protection to man as well as other organisms. Fruits of forest trees are the source of food for a number of animals. Forests regulate the flow of water in the streams, prevent soil erosion and make the environment very pleasant.

Forests provide us with (1) timber (construction wood for houses) (2) fire wood (3) medicine (herbal medicine, honey, wax) and many other products.

Regions with high rainfall (average 20 inches) are suitable for tree growth. Trees are called environmental buffers; they intercept heavy rainfall and release the water steadily and slowly to soil beneath and to the streams and rivers that start in or flow through them, the tree roots hold the soil in place. Removal of forests allows soil erosion, silting up of lakes and rivers and dams, heavy floods and the loss forever of thousands of species of animals and plants. The disastrous floods in India and Bangladesh in recent years may be attributed to deforestation.

Forest and Climate:

About half of the rain which falls in tropical forests comes from the transpiration by the trees themselves which also keep the environment cool and humid. When forests are removed, this source of rain is also removed. Cloud cover is reduced and the local climate changes quite dramatically. The temperature range from day to night is more extreme *i.e.*, the difference between day and night temperatures increases considerably, and the rainfall diminishes.

Forest and Biodiversity:

One of the most characteristic features of tropical forests is the enormous diversity of species they contain. Biodiversity refers to "the total number of different species within an ecosystem and the resulting complexity of interactions among them."

Q.8.(a) Describe fruit set and fruit ripening in angiosperms. (4)

Ans **Fruit set and Fruit ripening:**

Germinating pollen grain is not only an important structure for safe transfer of gametes and insurance for fertilization but also a rich source of auxins as well as commonly stimulating the tissues of the style and ovary to produce more auxin. This auxin is necessary for 'fruit set', i.e., retention of the ovary, which becomes the fruit after fertilization. Without it, abscission of flowers normally occurs, leading to low fruit yields. After fertilization, the ovary and the ripe seeds continue to produce auxins which stimulate fruit development. Developing seeds are not only a rich source of auxins and gibberellins, but also of cytokinins. These growth substances are mainly associated with development of the embryo and accumulation of food reserves in the seed and sometimes in the pericarp (fruit wall).

Fruit ripening is often accompanied by a burst of respiratory activity called the climacteric. This is associated with ethane production, which helps in ripening of the fruit.

(b) What is X-linked recessive inheritance? Explain it with an example. (4)

Ans **X-linked recessive inheritance:**

Experimental matings are not practically possible in humans. Mode of inheritance of human traits can be traced through pedigrees.

Genetics of colour-blindness:

Normal trichromatic colour vision is based on three different kinds of cone cells in the retina, each sensitive to only one of the three primary colours, red, green or blue. Each type of cone cell has specific light absorbing proteins called opsins. The genes for red and green opsins are on X chromosome, while the gene for blue opsin is present on autosome 7. Mutations in opsin genes cause three types of colour-blindness. A dichromat can perceive two primary colours but is unable to

perceive the one whose opsins are missing due to mutation. Protanopia is red blindness, deuteranopia is green blindness, while tritanopia is blue blindness. Some people can detect red and green but with altered perception of the relative shades of these colours. They have abnormal but still partially functional opsins. They are protanomalous and deuteranomalous for red and green weakness respectively. A monochromat can perceive one colour. Monochromacy is true colour-blindness. Blue cone monochromacy is an X-linked recessive trait in which both red and green cone cells are absent. That is why, it is also called red-green colour-blindness. It is a common hereditary disease. Like any sex-linked recessive trait, it also zigzags from maternal grandfather through a carrier daughter to a grandson. It never passes direct from father to son. This type of colour-blindness is more common in men than women, because chances for a male to be affected by it are much more than a female.

Q.9.(i) Describe various types of meristems. (4)

Ans For Answer see Paper 2021 (Group-I), Q.9.(a)

(b) How did eukaryotes evolve from prokaryotes? (4)

Ans One of the speculations trying to explain the origin of life is that it may have begun deep in the oceans, in underwater hot springs called hydrothermal vents. These vents could have supplied the energy and raw materials for the origin and survival of early life forms. A group of bacteria, called archaeobacteria, that tolerate temperatures up to 120°C and seem to have undergone less evolutionary change than any other living species supports this vent hypothesis.

The nutrients produced in the primitive environment would have limited early life. If life was to continue, another source of nutrients was needed. Photosynthesis, probably freed living organisms from a dwindling supply of nutrients. The first photosynthetic organisms probably used hydrogen sulphide as a source of hydrogen for reducing carbon dioxide to sugars. Later, water served this same purpose, and oxygen liberated by photosynthetic reaction began to accumulate in the atmosphere. Earth and its atmosphere slowly began to change.

Ozone in the upper atmosphere began to filter ultraviolet radiation from the Sun, the reducing atmosphere slowly became an oxidizing atmosphere, and at least some living organisms began to utilize oxygen. About 420 million years ago, enough protective ozone had built up to make life on land possible. Ironically, the change from a reducing atmosphere to an oxidizing atmosphere also meant that life could no longer arise abiotically. The first cells were most likely very simple prokaryotic forms. The prokaryotes may have arisen more than 3.5 billion years ago. Eukaryotes are thought to have first appeared about 1.5 billion years ago. The eukaryotic cell might have evolved when a large anaerobic (living without oxygen) amoeboid prokaryote ingested small, aerobic (living with oxygen) bacteria and stabilized them instead of digested them. This idea is known as the endosymbiont hypothesis and was first proposed by Lynn Margulis. According to this hypothesis, the aerobic bacteria developed into mitochondria, which are the sites of aerobic respiration and most energy conversion in eukaryotic cells. The possession of these mitochondria-like endosymbionts brought the advantage of aerobic respiration to the host.

Flagella (whip-like structures) may have arisen through the ingestion of prokaryotes similar to spiral-shaped bacteria called spirochetes. Ingestion of prokaryotes that resembled present-day cyanobacteria could have led to the endosymbiotic development of chloroplasts in plants.

Another hypothesis for the evolution of eukaryotic cells proposes that the prokaryotic cell membrane invaginated (folded inward) to enclose copies of its genetic material. This invagination resulted in the formation of several double-membrane-bound entities (organelles) in a single cell. These entities could then have evolved into the eukaryotic mitochondrion, nucleus, nucleus, chloroplast, etc.

Whatever the exact mechanism for the evolution of the eukaryotic cell might be, the formation of the eukaryotic cell led to a dramatic increase in the complexity and diversity of life-

forms on the Earth. At first, these newly formed eukaryotic cells existed only by themselves. Later, however, some probably evolved into multicellular organisms in which various cells

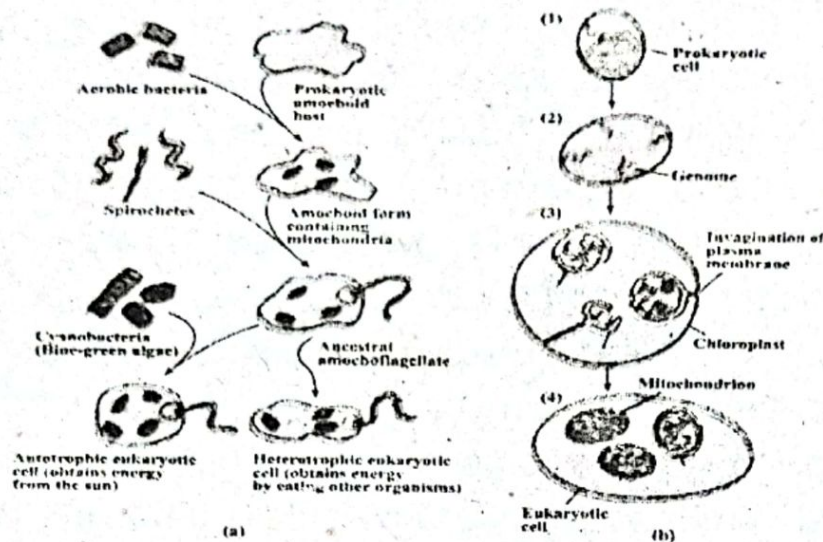


Fig. Two hypothesis on the evolution of the eukaryotic cell.

(a) Endosymbiont hypothesis, (b) Membrane invagination hypothesis. (1)

A prokaryotic cell (2) Duplicates its genetic material (genome) (3) The plasma membrane then invaginates to form double membrane-bound organelles, and the individual genomes separate from each other (4) The nuclear genome eventually enlarges, while the other organelle genomes lose many of their genes, resulting in a eukaryotic cell.

became specialized into tissues, which, in turn, formed organs for many different functions. These multicellular forms then adapted themselves to life in a great variety of environments.

Babulim